CSE 311 Quiz Section 2: Apr 10, 2014

1 Student Questions

2 Problem 8 from Homework #1

42. Suppose that a truth table in n propositional variables is specified. Show that a compound proposition with this truth table can be formed by taking the disjunction of conjunctions of the variables or their negations, with one conjunction included for each combination of values for which the compound proposition is true. The resulting compound proposition is said to be in disjunctive normal form.

3 Practice Problems

1. How many different Boolean functions on n variables are possible? (A "Boolean function on n variables" is specified by a truth table with $n + 1$ columns, one for each variable and one for the value of the resulting function. There are as many Boolean functions as there are distinct truth tables.)

2. Logical equivalence with quantifiers

   7th edition: 1.4: 43, 45;   6th edition: 1.3: 43, 45

   Determine whether the following are logically equivalent:

   (a) $\forall x(P(x) \rightarrow Q(x))$ and $\forall x P(x) \rightarrow \forall x Q(x)$
   (b) $\exists x(P(x) \vee Q(x))$ and $\exists x P(x) \vee \exists x Q(x)$

3. Translate English to logical expressions with nested quantifiers.

   Both editions: 1.5: 9

   Let L(x,y) be the statement "x loves y"

   (a) There is somebody whom everybody loves (c)
   (b) Nobody loves everybody (d)
   (c) There is exactly one person whom everybody loves. (g)
   (d) Everyone loves himself or herself. (i)
   (e) There is someone who loves no one besides himself or herself. (j)

4. (Section 2.22, Exercise 12-13, 7th Edition) Prove the following (these are called absorption laws):

$$(a) \quad A \cup (A \cap B) = A$$
$$(b) \quad A \cap (A \cup B) = A$$

5. (Section 2.1, Exercise 9, 7th Edition, modified slightly) Determine which of these statements are true and which false

   (a) $0 \in \emptyset$
   (b) $\emptyset \in \{0\}$
   (c) $\{0\} \subseteq \emptyset$
   (d) $\emptyset \subseteq \{0\}$
   (e) $\{0\} \in \{0\}$
   (f) $\{0\} \subseteq \{0\}$
   (g) $\{\emptyset\} \subseteq \{\emptyset\}$